

## NATIONAL AIRSPACE SYSTEM (NAS) PROGRAM INITIATIVE

1. TITLE: Application of Satellite Navigation Capability for Civil Aviation (Amends subject Mission Need Statement to add continuous monitoring and predictive capabilities through a central facility)
2. NPI NUMBER: 0050 (Amendment)
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8. MISSION NEED:

The FAA initiated the Satellite Navigation program to provide cost-effective navigation service by transitioning the National Airspace System (NAS) from a land-based to a space-based navigation system. The transition requires a central facility to continuously monitor and predict end-to-end satellite navigation system performance, and the ability to provide this key satellite navigation information to users of the NAS. Monitoring and prediction capabilities are a direct outgrowth of satellite navigation development.

9. CURRENT CAPABILITY:

The FAA's Satellite Navigation Program was established to transition the NAS from land-based to satellite-based navigation. Satellite navigation will provide the following benefits to the FAA and aviation community.

- a. Substantial savings due to:
  - (1) Consolidation of navigation functions into a single satellite-based system enabling FAA to phase out existing land-based navigation aids,
  - (2) Implementation of accurate area navigation through efficient, optimized, user- preferred flight paths yielding fuel savings for users, and
  - (3) Use of efficient route structures yielding significant reductions in aircraft operating costs;
- b. Improved safety with reduced separation minima resulting in increased system capacity;

- c. Accurate position reporting to enable uniform high-quality, worldwide Air Traffic Management (ATM);
- d. Increased landing capacity with up to Category I precision approach service to all runways and airports for all types of aircraft;
- e. Category II/III precision approach services; and
- f. Improved ground and cockpit situational awareness, reducing runway incursions.

The FAA has initiated two independent but complementary systems to augment the Department of Defense's Global Positioning System (GPS) to meet civil aviation's navigation and safety requirements: the Wide Area Augmentation System (WAAS) and the Local Area Augmentation System (LAAS). WAAS will provide primary means navigation for en-route through Category I precision approach, and will reach Initial Operating Capability (IOC) in June 1999. LAAS will provide Category II/III precision approach capability, and will reach IOC in 2001. In addition, international augmentation systems similar to WAAS such as the Canadian WAAS (C-WAAS), Multi-functional Transport Satellite (MTSAT) Satellite-based Augmentation System (MSAS) and European Geostationary Navigation Overlay System (EGNOS) will require integration with WAAS and LAAS to create a seamless Global Navigation Satellite System (GNSS), a goal of the International Civil Aviation Organization (ICAO).

#### 10. PLANNED CAPABILITY:

The FAA requires a central facility to monitor and predict satellite navigation system performance. Additional benefits of a central facility include the ability to: provide additional operational information to users of the NAS, comply with international standards, and conduct pre-planned product improvement (P<sup>3</sup>I) to the operational systems through satellite navigation research and development activities.

- a. *Monitor and Predict Satellite Navigation System Performance:* Provide the capability to continuously monitor the performance of the WAAS—and in the future, all satellite navigation systems, and to predict degradations of satellite navigation services based on analyses of historical performance data. Satellite navigation systems to be monitored include the Global Positioning System (GPS) and Global Overlay Navigation Satellite System (GLONASS), and the associated augmentations (WAAS, LAAS, CWAAS, EGNOS, MSAS) and other future systems. Combined monitoring of these systems from independent data sources will provide key performance and predictive navigation information that is not planned for these systems individually. The combined capabilities from the different augmentation systems will be integrated from an operational performance perspective so that service disruptions to users are minimized.

- b. *Provide Operational Information to Users of the NAS*: Provide the user community with access to key system performance and predictive navigation information, including but not limited to updates to aeronautical databases, and Notice to Airmen (NOTAM), as well as the capability to report and be alerted to signal anomalies. For example, the central facility will identify and verify any interference to the satellite navigation signal and forward this information to the National Flight Data Center (NFDC) for NOTAM generation. Simultaneously, the central facility will determine the source of interference to maintain minimum effect on navigation service in the affected area.
- c. *Comply with International Standards*: Other Satellite-based Augmentation Systems (SBAS) such as C-WAAS, MSAS, and EGNOS, and international satellite systems such as GPS and GLONASS must meet Global Navigation Satellite System (GNSS) international standards being developed to ensure a seamless navigation capability throughout the international community. The central facility will be the primary vehicle by which the FAA will interface with international systems to ensure WAAS and LAAS are interoperable with other augmentation systems in accordance with ICAO standards. As additional augmentation and satellite systems are developed, the central facility will have the capability of monitoring their performance to augment predictive capability for the NAS. The central facility will also have the capability to coordinate and verify the performance of international satellite and augmentation systems before they are approved for integration with systems in the NAS.
- d. *Conduct Pre-Planned Product Improvement (P<sup>3</sup>I)*: Provide the GPS Product Team (PT) with the ability to develop and implement technology advancements into satellite navigation systems thereby reducing out-year costs and improving system performance. Examples include increased accuracy, information transfer directly to the cockpit, improved user equipment, future space architecture requirements, a time transfer capability, and an Automatic Dependent Surveillance (ADS) capability.

#### 11. IMPACT OF DISAPPROVAL:

A central satellite navigation facility will provide a means to continuously monitor and predict end-to-end satellite navigation performance and to provide the aviation user community with information required to safely operate in the NAS. This information includes, but is not limited to: expanded level-of-service performance information, system operations and maintenance information, status and resolution information for signal anomalies, updates to terrestrial aeronautical information, and NOTAM information to NFDC.

The overall impact of disapproval of this amendment to the mission need will result in the agency's inability to continuously monitor and predict system performance. It is critical that the monitoring capability is in place by mid-1999 for initial commissioning of the WAAS. Disapproval will also negate the agency's ability to provide this key satellite navigation information to users of the NAS. This can be expected to adversely impact safety, user acceptance, and contractor compliance. In addition, the lack of a centralized satellite navigation facility will disrupt US capability to provide the

technological basis for GNSS, will hinder US capability to comply with international standards, and will continue to fragment P<sup>3</sup>I satellite navigation research and development efforts.

a. Alternatives:

- (1) Continue with current satellite navigation system implementation, fielding each augmentation to satellite navigation as a separate capability without the ability to independently monitor and predict system performance.
- (2) Develop a central facility from which to monitor and predict national and international satellite navigation services.

b. Action Plan:

The centralized satellite navigation facility will provide the capabilities discussed in Paragraph 10, above. The 18-month development program will include:

- (1) Renovation of Building 56, US Naval Observatory,
- (2) Development of detailed requirements for the central facility's technical services,
- (3) Development of technical services:
  - (a) Design technical services architecture,
  - (b) Assess and build data collection and storage capabilities,
  - (c) Assess and build software data analysis and prediction capabilities,
  - (d) Develop and test software interfaces,
  - (e) Select and integrate hardware, software, and communications,
  - (f) Conduct operational testing,
- (4) Acceptance and operation of technical services.

c. Cost Estimate:

The Facilities and Equipment (F&E) cost estimate covers facility renovation, communications installation, acquisition and integration costs of hardware, software, and technical support required to provide the capabilities described above. Interface software will be developed for data flow to and from the central facility and to accomplish analyses and predictive capabilities as described above. Costs not included below are: annual operating costs for the GPS Product Team, connectivity with future international satellite navigation systems, and integration of LAAS stations into the facility's technical services beginning after 2001. All anticipated categories of cost were estimated and are listed in the following table.

## COST TABLE NOT BEING PROVIDED

- d. Conclusion: A central facility will provide monitoring and predictive capabilities that are necessary to users but not previously planned within the Satellite Navigation program. These capabilities will facilitate safety by providing additional navigation data to users, will maintain the US technological lead in satellite navigation, and will yield substantial savings by consolidating the agency's satellite navigation research and development activities.

The transformation of the NAS from land-based to space-based navigation will take place over many years as technology and user acceptance allow. A central facility is required to develop the capability within the Agency to manage and implement the transition safely in the most cost effective manner.